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CONSTRUCTION PROBLEMS OF SMALL APARTMENT HOUSES; USE OF LOCAL CONSTRUCTION MATERIALS IN HUNGARY

Magyar Epitoipar
[Hungarian Building Industry], No 8,
1955, Budapest,
Pages 354-357

Gustav Berkenyi

The construction of small apartment houses is a significant construction problem. The character of the urban and rural surroundings and the needs and problems arising from these significantly affect the mode of execution. Thus, beyond planning considerations the classifying of structural problems is also necessary.

Urban Small Apartment House Construction

Compared with the construction of mass apartment dwellings the construction problem of small apartment houses loses significance. Here the significant type of apartment building is the multiapartment house. The structural questions connected with this, the question of prefabrication, the degree and usability of uniformity is today an already clear question. The possibilities are widely known. The construction of small apartment houses in urban areas is of secondary importance when compared with the preceding, its problems of structure and execution stand close to general building practice (prefabrication, transportation, and labor recruitment).

Rural and Village Small Apartment House Construction

The characteristic of rural and village construction projects is their distance from one another in both time and space. Even current construction methods would not become usable by ordinary relocation. Uniformity and mechanization, the basic assumptions of large industry, are not generally applicable to rural areas, but particularly not to individual private home construction.

The execution of construction of small apartment houses has to be formed by considering the given situation, as well as modification of general practice.

Organization of Construction

(a) Urban

In foreign professional publications we meet with examples of the organization of large industry as well as with the exploitation of local industries. Large industry depends on special transportation firms for distribution. These firms resemble the generally known transportation companies in their structural and organizational characteristics and differ mainly in their mobility.

Because they have the basic characteristics of a large industry they possess some basic components of the building technology. The "Modul" system, the types and the development of types and specifications are necessary requisites. Their functioning is only expeditious in urban construction supported by them. It does not seem practicable or workable for these firms to satisfy individual needs with the existing time and space problem.

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(b) Rural

In our country private house construction is a significantly individual problem. It would be ideal to find an answer to this problem which would satisfy local demands and peculiarities by the exploitation of these very situations. The problem is new and therefore we rarely meet already worked out and generally accepted theoretical principles, planning theory and direction or structural solutions even in foreign practice and professional publications. To deal with the structural part of the problem, the question, concisely stated, is which structural elements can be most completely and economically used for this special type of construction.

Are certain economically produced concrete elements such as "gas," "foam" or "porous" concrete usable? Are certain local building materials such as reed, limestone, tufa or clay usable?

Aside from their use, in what form should they be prepared? And on what organizational level is their production most easily imaginable?

Foreign Experiences

(a) Materials, Structures

The examples to be introduced in the first part of the detailed discussion serve only to illustrate that prefabrication connected with apartment building abroad is in its beginning stages and branches in many directions. The German concrete made of porous vulcanic glass-like stone "swelling" clay concrete and various "gas" concretes; the Swedish "Siporex," the English Bell-rock plaster panels; the "Chock vibration concrete" of Dutch origin or, for instance, the Soviet "Keramzit"-concrete are all significant milestones in experimentation with structural materials. Frequently appearing professional evaluations in foreign professional literature tend to prove that much knowledge is required for finding solutions, correlating results and experiences and, furthermore, that the problem is considered exciting and timely abroad as well. In order to get a taste of the development of structural materials abroad we will present a few short explanations of some solutions.

In Germany "swelling clay" concrete is a significant substitute for light concrete. On the basis of available opinions the substance produced is of the same value as other light concrete substitutes. Its disadvantage is that its production requires a good deal of coal so that its economy can justly be questioned.

At the same time interesting experimentation is under way with a certain shale to be used as an additive. The great oil content of this substance may, at the time of the burning off of the elements, result in a saving of approximately 60 percent in coal.

Depending on the local area where sawdust, woodshavings or excelsior are available so-called "wood-concrete" can be produced. The acidization of the additive averages 1:10 with a water and glass mixture. Their use, however, is more significant in the insulation and soundproofing fields. The practicability of using "gas," "foam" or "porous" concrete. (Their composition: Portland-cement, fine quartz sand, hydrogen superoxide and chlorinated lime)is proven in many German examples. (The house built in Soll near Munich). The measurements of the elements used were 2.50 x 0.5 x 0.15 m, their weight approximately 150 kg. These characteristics assure easy handling.

The "vibration" concrete is characterized more by its construction than

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by its basic material. (The exactness of measurements, durability, attractive exterior and appearance.) An important figure proving the usability of "Chock" type "vibration" concrete is the fact that over one million window frames in Holland have been made out of this material.

The English "Bellrock" plaster panels have special structural specifications. The weight of the roof is supported by interior walls and the roof-frame section by the exterior brick covered panel walls. In order to exploit most completely the peculiarities of this material the prefabricated elements are built in in reverse order (order for construction: interior and partition walls, roofing, roofing structure).

(b) The Organization of Construction Projects

In connection with the above materials, centralized factory prefabrication comes into the foreground abroad. The reason for this is the easier control of manufacturing, greater economy of material, more attractive and exact execution, shorter on-the-spot construction time and less need for on-the-spot working space.

Local Construction Materials

Aside from the use of centralized factory produced materials which were made known above, one will now have to bring out the primary goal of the exploitation of local construction materials. An economic order which considers economy a basic theory cannot afford to disregard the rational advantages which come from using local materials. These thoughts are directed towards reed, stone, slag, and clay.

Let us then proceed in details to the best known and most widely spread construction material connected with the "Private House Development Program" which is clay or rather adobe.

The General Characteristics of Clay

The most important advantage of clay over the other basic construction materials such as reed, stone, and slag is that its occurence is most widely spread and its availability at almost every construction project is assured. [redacted] of this there are several such economic and rational demands which regulate its use as a construction materials and the observance of which is a basic requirement.

1. Clay is a local type of construction material; only the use of clay procured on the spot is economical. Because of its great weight -- 2000 kg per cubic meter in its damp state -- transporting it does not pay. By using it, brick, cement, lime and fuel can be saved and finally the reduction of the strain on the communications system is also advanced. To prove the great significance of this economy measure was, we will quote some statistical data of NDK. According to this, from approximately 17,000 adobe construction projects (a volume of 125,000,000 D-marks) 200,000,000 bricks, 40,000 tons of lime, 110,000 tons of coal and 750,000 tons of transportation space were saved.

2. Adobe while not exclusively, nevertheless mostly a rural or village construction material, thus its use is best justified in rural areas.

3. Apart from its advantages adobe is only a substitute and a complementary type of material; it is justified by special economic considerations or by low industrial developments.

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4. Construction with adobe is problematical and requires much experience. The construction techniques are not simple. The basic material for adobe construction is clay. Its structure and first preparation will sometimes alter the mode of its use in construction.

5. Under a carefully carried out construction project the cost of repair at the end will remain normal. (According to a German figure, with an investment of 130 million, this capital saving represented 0.7% of the investment).

6. The technology of adobe construction has to be developed and improved in accordance with the technical requirements of the age.

What are the technical construction characteristics of clay as a basic material for construction?

Clay is a natural mixture of colloidal chrystal and minerals (quartz); its composition can be considered a natural mixture in which the scale-like parts -- as in cement -- serve as a binding substance. In the so called "fat clay" the scale-like clay particles represent larger proportions -- the working-up -- and melting requires more water. The scale-like elements increase inner cohesion thus making the firmness of "fat clays" greater and a more valuable substance.

Advantages:

(a) Easily accessible.

(b) Good insulator. The heat conducting value of the material is 0.75 kcal/mh degrees C which is lowered by 0.80 kg/cubic meters if mixed with a fibrous additive so that the entire figure may be lowered to 0.2 kcal/mh degrees C.

(c) Good sound-proofing material.

(d) In an air-dry condition it has a certain degree of conserving effect.

(e) Nonflammable.A 25 cm thick adobe wall is fireproof.

(f) Can be nailed -- particularly with nails which have previously been dipped in vinegar.

(g) "Breathing" wall. Amount of fumes in the enclosed space automatically adjusts itself.

(h) Currently the building expense is approximately 12% lower than for a brick constructed building.

(i) Its use requires fewer specialized workers.

(j) Due to its good insulating capacity (with an approximately 40 cm thick wall) a fuel saving of 20% can be reached.

Disadvantages:

(a) Water absorbent; requires careful insulation against water.

(b) Sensitive to frost; therefore the building period spreads only from May to September thus being seasonal.

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(c) Low "pressure-firmness" value.

(d) Shrinks significantly, a property particularly outstanding with fat clays. This cannot exceed 2%. If the basic material is carefully treated with mineral and plant substance this property can be decreased.

Preparation of Clay

Before natural clay is used it should be mixed depending on its particular properties with other materials. These admixtures are either of mineral origin such as sand, gravel, stone or brick or of vegetable origin such as straw or chaff. These materials have thinning, lightening, loosening, and from an inner tension point of view binding qualities. The material mixed either by hand or machine -- clay plus additive -- is adobe. The preparation of adobe can take place in its damp plastic and liquid state. The damp adobe becomes pounded or pressed adobe-brick or walls. The moldable adobe is mixed with a fibrous supplementary material and becomes adobe-bricks and slabs. The liquid adobe is worked into light bricks, light shaped slabs, roof shingles and mud used in the preparation of adobe.

Structural Elements

(a) Adobe blocks

The regular and generally known adobe brick which is prepared for distribution by pounding or pressing varies in size between 38x25x12, 38x18x12 and 25x12x12. After having made the above known, we will now occupy ourselves with a few types of building elements especially composed and with specific purposes.

Light-Brick. Mainly prepared by hand pressed out of medium or fat clay with supplements of rope and chopped straw. In the event that fat clay is used 70 kg per cubic meter of supplementary material is added to the mixture. It is a good sound insulator. Its heat-conducting capacity is 0.2 kcal/mh degrees C. It cannot be built into a weight supporting position. Its use in a wall of mixed construction materials (either in adobe which has not been mixed with a fibrous supplementary material or in a baked brick wall) is not desirable because of its varying settling properties. Two usual forms are known: the 50/12/6 cm shaped brick and the 50x15x12 cm light block.

Adobe with fibrous supplementary material added. The supplementary material is chaff or rope less than 5cm long. The minimum thickness of the sheet is 5 cm, but generally 8 to 10 cm. The weight of a 75x80x8 cm sheet at its driest is 25 kg. Its advantage is, that because of cheap molding, alteration can be made to suit all needs. It can be prepared for distribution either by pressing or by putting them into moulds. In order to absorb the curvature 2 or 3 wooden rods of an approximate diameter of 3 cm have to be pressed into the approximately 32 cm wide element. Before the wooden rods are worked in they must be soaked in clay mud. This is similar to the process used with the insertion of metal rods into reinforced concrete. The elements are used for slanted or flat roofs or as floor lining, as well as in wooden, iron, or reinforced concrete roofing as inner lining and partition sheets. The inner lining is prepared according to whether or not the rafter work is visible or hidden, in the form of an approximately 100x25x60 to 10 cm partition wall sheet in smooth or grooved form.

Straw Shingles

Until now 60 to 90 cm wide elements were used for the preparation of

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Figure 1. The Installation of Chock-Method Vibration Concrete Structure. [photo]

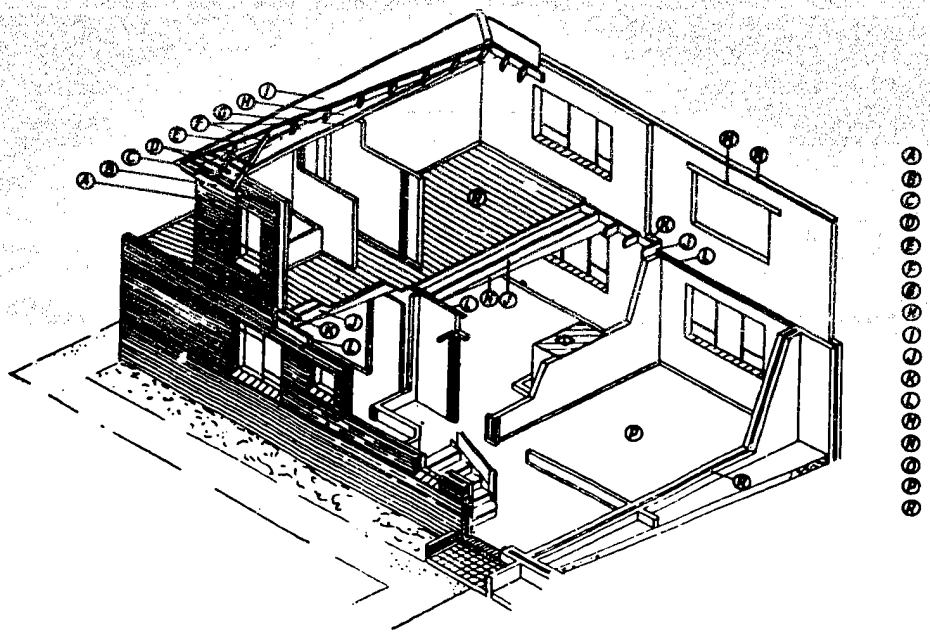

Figure 2. The inner shell and all partition walls are made of "Bellrock" panels.

A, 4 1/2 covering bricks; B, moulding sheet; C, asbestos drains; D, roof-tile holding-rods; E, ridge rafters; F, roof rafters; G, ceiling beams; H, groove edged roof-covering sheets; I, concrete slabs; J, roofing beams (floor); K, wooden sheets; L, rolled T-iron; M, rolled angle-iron; N, wooden roof sheet; O, T and G floor covering sheets; P, local floor covering; R, partition wall.

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